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ABSTRACT

This booklet on ecosystems is one in a series on environmental education for grades K-12. The activities explore the structure and dynamic nature of ecosystems, as well as the interactions between humans and ecosystems. Four basic behavioral objectives are listed with activity options and appropriate subject areas. Each activity includes materials and resources, procedures, and discussion questions. The twelve activities are interdisciplinary and are designed for high school students, grades 9-12. Materials include illustrations, data sheets, worksheets, and case studies. (MA)

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ED149993

ECOSYSTEMS

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GRADES

ENVIRONMENTAL EDUCATION

VALUES FOR THE FUTURE

ANTIOCH COMMUNITY SCHOOL DISTRICT 34

TITLE IVC ESEA

SE 023 463

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EXPLANATION OF CONCEPT AREA

ECOSYSTEMS - In any program of environmental education we must include material to help students develop a clearer understanding of basic ecological principles.

We begin this process by defining the basic components of a simple system, its energy source, definition, and basic relationships.

We then build upon this to define place, energy, interactions, and the problems of pollution of ecosystems.

In grades 6-8 we focus on the complexity of ecosystems, energy forms and transfer in ecosystems, and the stress capacity of ecosystems.

In high school the students use their previous experiences to further explore the structure of ecosystems, their dynamic nature, and the interactions between humans and ecosystems.

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to identify balances between some living and non-living components in an ecosystem.

SUBJECT AREAS:

Science

2

OPTION #1 - one class period

MATERIALS AND RESOURCES

Chart 1

PROCEDURE:

1. Ask each student to fill out the baker's dozen form for items he/she values most.

2. From these items develop a dependency list on the blackboard. The teacher can list them in categories of living and non-living if he so chooses.

3. Discuss the interrelationship between these groups.

DISCUSSION QUESTIONS

1. How do you, the living dependencies, and the non-living dependencies represent a balance or interaction?

2. How would the alteration of one of these items affect the others?

3. A system maintaining an equilibrium even with constant change is said to be in dynamic balance. How does nature maintain dynamic equilibrium, e.g. food chains, cycles, changes?

4. What role does man play in the dynamic equilibrium of the environment? (This question could lead in many directions and could easily lead into other units in this program.)

BAKERS DOZEN

		RANK ORDER
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

OPTION #2

MATERIALS AND RESOURCES

Hardwood Forest Community Structure, FS/C, E^2 Office

Pencil and paper

Wooded area for study

Life in a Log, Centron FS/C, E^2 Office

Clearvue transparencies on varieties in the environment, E^2 Office

PROCEDURE: DAY 1

1. Show the students the filmstrip and compare the strip to the site to be visited. Point out the key words and dependencies in the ecosystem.

2. State the trees will be in various states of decay and will have various forms of life and non-life. You may or may not wish to refer to the succession process.

3. The class will split up into groups and each group will examine a log either listing the forms of life and non-life on a sheet of paper or collecting specimens and returning them to the laboratory for further study and identification.

4. The instructor should choose various stages in the succession for the various groups.

   a. standing dead tree
   b. newly fallen dead tree
   c. partially decayed log
   d. log in advanced stages of decay

PROCEDURE: DAY 2

1. On the second day, take your field trip to a wooded lot. Try to find the following:

   a. insects and other (arthropods)
   b. snails
   c. birds
   d. mammals
   e. fungus
   f. plants
   g. bird or animal excrement
   h. dead animal remains
   i. seeds
   j. lizards
   k. evidence of moisture
   l. other

2. See if you can place all of the items found into some orderly arrangement.

OPTION #2 con't

DISCUSSION QUESTIONS DAY 3

1. Compile lists of the kinds of life and non-life found in each stage of decay.

2. Why do the different stages exhibit different kinds of life and even different kinds of non-life?

3. Are the kinds of inhabitants of the log dependent upon the condition of the log at that specific time?

4. As an organism takes up housekeeping in his log, does his occupancy ultimately destroy it for his own use?

5. Does one organism's use of the log eventually prepare the log for use by another?

6. What would happen to the entire log habitat if the log was

   a. frozen for fifty years?
   b. sprayed with deadly poison or coated with creosote as in the case of telephone poles?
   c. partially burned?
   d. totally immersed in water?
   e. thrown out on the desert?

7. In light of the above, explain the interrelationships of living and non-living factors in the environment and why is dynamic balance important?

OPTION #3

MATERIALS AND RESOURCES

1. Collect three large (1-5 gallon) water samples from three separate bodies of water from cleanest to dirtiest (ponds or streams).
2. Life in a Pond, Centron FS/C, E^2 Office
3. 10 clearvue H_2O pollution transparencies, E^2 Office
4. H_2O test kit, D.O., CO, Hardness, pH, phosphate
5. Microscopes
6. Plankton net
7. Dissolved oxygen bottle (D.O.)
8. Thermometer
9. Three aquaria
10. Gelatin or methyl cellulose

PROCEDURE:

1. Place the H_2O samples in the aquaria where students can have access to them. They are the source for all the tests and observations.
2. Divide the class into groups for each of the following tasks:

   a. plankton screening and counting (plankton net)
   b. dissolved oxygen and temperature data
   c. hardness and pH data
   d. CO and phosphate data
   e. invertebrate identification, number of species (microscope)
   f. algae identification, number of species

3. Have the students place their data on the class data form enclosed. The algae and plankton should be illustrated by the observers and the number of different distinct organisms listed.
4. When the students have completed all the blanks on the chart, use the filmstrip and transparencies to discuss water quality.
5. Focus on interrelationships within an ecosystem.

DISCUSSION QUESTIONS

1. Was the pond more or less complicated than you expected? Explain.
2. How does temperature affect the various other factors?
3. How did "pollution" affect the various factors on your chart?
4. What were the living and non-living components in your system?
5. How do these components interrelate?

ECOSYSTEMS 16
OPTION #3

TEST PERFORMED	CLEANEST SITE #1	SITE #2	DIRTIEST SITE #3

8

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to identify adaptive changes in ecosystems.

SUBJECT AREAS:

Science

KEY WORDS AND DEFINITIONS:

Adaptation - A structural or behavioral characteristic that enables an organism to cope with and make good use of the factors in its environment.

Natural selection - The agent of evolutionary change by which the organisms possessing advantageous adaptations produce more offspring than those lacking such adaptations.

Evolution - A series of related changes in a certain direction; process of change; process of organic development.

OPTION #1 - two to three days

MATERIALS AND RESOURCES

Life in a Pond, FS/C

Sand Dune to Forest or Rock to Forest, FS/C

Rock to Forest transparencies

Pond to Forest transparencies

PROCEDURE:

1. Discuss biotic and abiotic conditions of the areas listed below using either the filmstrip, Pond to Forest or Rock to Forest, E² Office.

   sparsely wooded area densely wooded area grassland

   Optional - If possible choose students to visit these areas prior to discussion and ask them to make a listing of plants and animals in that area.

2. Re-examine the conditions of each and explain how it contributes to the production of the next stage of succession.

DISCUSSION QUESTIONS

1. What are the abiotic conditions of a forest or pond area?

2. How abundant and how diversified are the biotic materials?

3. What factors in the area contribute to the destruction of one stage and give rise to a new stage of succession?

   NOTE: An excellent example of this point can be viewed at Lake Itasca, Minnesota, headwaters of the Mississippi. A beautiful stand of virgin Red Pine is present but unless a forest fire goes through and burns the litter, their seeds cannot germinate, hence things like balsam fir, etc. will germinate and eventually replace the pines. Hence, even a forest fire serves a purpose and is a factor in changes which take place in an ecosystem.

4. How do these examples illustrate that all natural systems are constantly undergoing adaptive change?

5. How does man affect changes in ecosystems?

6. Examine the ecosystem in your lawn and determine how dependent we are upon pesticides and herbicides to control the natural changes.

OPTION #2 - three lab periods

MATERIALS AND RESOURCES

Access to friendly hospital personnel
test tube with 2 ml. sterile saline per student
sterile cotton swabs
1 glass spreader made from glass tubing per student
Date chart
alcohol
Five (5) 1 ml. pipettes per student
incubator
green velveteen squares, approximately 6"x6"
wood tampoon for replica plating
forceps
Bunsen burners
rubber band

1 set of plates per student

a. Staph 110 media
b. Staph 110 media plus antiseptic
c. Staph 110 media plus penicillin*

Antiseptics: a solution of 70% isopropyl alcohol plus iodine for a 1% solution, full strength lysol, hydrogen peroxide, or a solution of 4 ml. Zepharin, 4 ml. alcohol and distilled water to 500 ml.

PROCEDURE:

Staph bacteria are present in the nasal cavity of all individuals. We shall attempt to compare the relative number of penicillin resistant strains present in the nose of a random sample of the population as compared to samples taken from doctors and nurses who work in an environment of close association with pencillin.

1. Preparing the culture

a. Using a long cotton-tipped swab, gently swab the inner surface of the subject's nose.
b. Swirl the swab vigorously in 2 ml. of .85% saline solution. (The concentration is not crucial.)
c. Using this stock solution, prepare a 1:10 and a 1:100 dilution by adding 1 ml. of the solution to 9 ml. of sterile saline solution with a 1 ml. pipette and 1 ml. of this new solution to 9 ml. of sterile saline.
d. Using three petri dishes containing Difco Staph 110 medium, innoculate each with the three solutions prepared above by adding .1 ml. of each solution to a plate and spreading with the spreader. Dip the spreader in alcohol and flame between innoculations.
e. Incubate for 48 hours in an incubator at 35°C or for three days at room temperature.

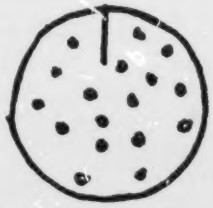
*Pencillin can be obtained from a cooperative pharmacist if you explain what you need it for. Dilute it until you have 2 IU's/ml. The pharmacist can give you dilution information.

This experiment works best with penicillin but the other antiseptics may be easier to obtain. //

OPTION #2 continued

2. Making the test

a. After the dishes have incubated, choose the plate that has a suitable distribution of colonies, numerous but well separated.



Draw a black line on one side to serve as a marker. The chosen plate will be your test plate and the rest can be discarded. Be sure to follow aseptic measure for handling and disposing of cultures.

b. Now we shall prepare three plates that will be exact replicas of your test plate. Plate 1 should contain sterile Difco Staph 110 media. Plate 2 should contain sterile Difco 110 media. Replicas will be made using the Lederbergh-Lederbergh technique and it is briefly outlined below:

(1) Find a wooden tampoon or glass beaker whose diameter is slightly less than that of the petri dish you are using.
(2) Locate a rubber band which will hold a piece of velveteen in place on the wooden tampoon or beaker.
(3) Have a sterilized square of green velveteen ready for use.
(4) Assemble the replicator as shown in Figure B. Each fiber of the velveteen will act as an innoculating needle when pressed against the test dish.

FIGURE A

FIGURE B

(5) Gently touch the replicator to the test dish lining up the black mark on the test dish with the black mark on the replicator. The fibers will come in contact with the colonies and will produce an exact replica of the plate when touched to another petri dish. Usually one touch will be sufficient for preparing 8-10 plates although we shall prepare only three.
(6) Touch the replicator to each of the three plates, again lining up the black marks so that you will always have a point of reference.
(7) Cover and incubate the plates upside down. They will appear similar to those below:

12

Option #2 continued

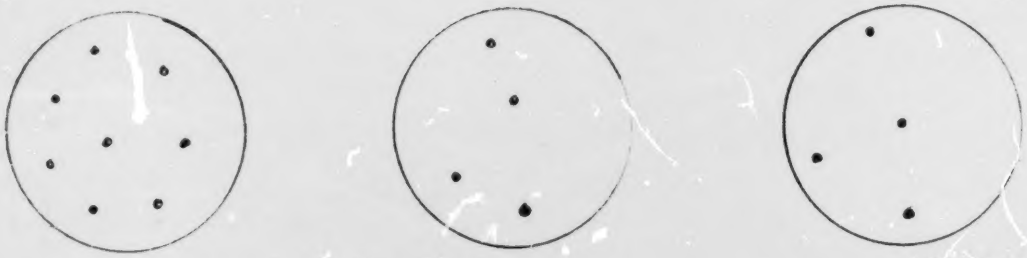


Plate A will appear exactly as the test plate appeared. All colonies will develop. Hold Plate A and the test plate up to the light lining up the marks, one superimposed upon the other to prove that they are identical.

Plates B and C will contain only those colonies that are resistant to the antiseptic. Non-resistant colonies will not develop. Again superimpose B on A and hold them up the light to readily see which ones did not develop. Do the same for Plate C.

DISCUSSION QUESTIONS

1. How did the number of resistant colonies compare from individual to individual and in particular how did they compare from non-medical subjects to medical subjects?

2. How do you account for the differences in the population of staph in the noses of medical and non-medical subjects?

3. Could the differences be considered environmental? Explain.

4. Might other populations of animals or plants be affected by changes in their environments?

   a. dinosaurs
   b. tree ferns
   c. buffalo
   d. rabbits

   } What kind of changes would affect them most?

5. How might a changing environment affect human populations? (lung development - poor air)

STUDENT DIRECTIONS

1. PREPARING THE CULTURE

   A. USING A LONG COTTON-TIPPED SWAB, GENTLY SWAB THE INNER SURFACE OF THE SUBJECT'S NOSE.

   B. SWIRL THE SWAB VIGOROUSLY IN 2 ML. OF .85% SALINE SOLUTION. (THE CONCENTRATION IS NOT CRUCIAL.)

   C. USING THIS STOCK SOLUTION, PREPARE A 1:10 AND A 1:100 DILUTION BY ADDING 1 ML. OF THE SOLUTION TO 9 ML. OF STERILE SALINE SOLUTION WITH A 1 ML. PIPETTE AND 1 ML. OF THIS NEW SOLUTION TO 9 ML. OF STERILE SALINE.

   D. USING THREE PETRI DISHES CONTAINING DIFCO STAPH 110 MEDIUM, INNOCULATE EACH WITH THE THREE SOLUTIONS PREPARED ABOVE BY ADDING .1 ML. OF EACH SOLUTION TO A PLATE AND SPREADING WITH THE SPREADER. DIP THE SPREADER IN ALCOHOL AND FLAME BETWEEN INNOCULATIONS.

   E. INCUBATE FOR 48 HOURS IN AN INCUBATOR AT 35°C OR FOR THREE DAYS AT ROOM TEMPERATURE.

2. MAKING THE TEST

   A. AFTER THE DISHES HAVE INCUBATED, CHOOSE THE PLATE THAT HAS A SUITABLE DISTRIBUTION OF COLONIES, NUMEROUS BUT WELL SEPARATED.

   DRAW A BLACK LINE ON ONE SIDE TO SERVE AS A MARKER. THE CHOSEN PLATE WILL BE YOUR TEST PLATE AND THE REST CAN BE DISCARDED. BE SURE TO FOLLOW ASEPTIC MEASURE FOR HANDLING AND DISPOSING OF CULTURES.

   B. NOW WE SHALL PREPARE THREE PLATES THAT WILL BE EXACT REPLICAS OF YOUR TEST PLATE. PLATE 1 SHOULD CONTAIN STERILE DIFCO STAPH 110 MEDIA. PLATE 2 SHOULD CONTAIN STERILE DIFCO 110 MEDIA. REPLICAS WILL BE MADE USING THE LEDERBERGH-LEDERBERGH TECHNIQUE. IT IS BRIEFLY OUTLINED BELOW:

STUDENT DIRECTIONS CON'T

(1) FIND A WOODEN TAMPOON OR GLASS BEAKER WHOSE DIAMETER IS SLIGHTLY LESS THAN THAT OF THE PETRI DISH YOU ARE USING.
(2) LOCATE A RUBBER BAND WHICH WILL HOLD A PIECE OF VELVETEEN IN PLACE ON THE WOODEN TAMPOON OR BEAKER.
(3) HAVE A STERILIZED SQUARE OF GREEN VELVETEEN READY FOR USE.
(4) ASSEMBLE THE REPLICATOR AS SHOWN IN FIGURE B. EACH FIBER OF THE VELVETEEN WILL ACT AS AN INNOCULATING NEEDLE WHEN PRESSED AGAINST THE TEST DISH.

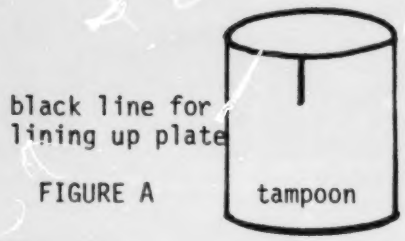


FIGURE A

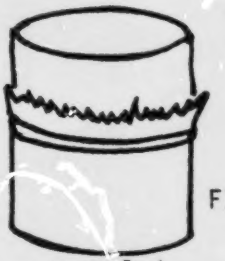


FIGURE B

(5) GENTLY TOUCH THE REPLICATOR TO THE TEST DISH LINING UP THE BLACK MARK ON THE TEST DISH WITH THE BLACK MARK ON THE REPLICATOR. THE FIBERS WILL COME IN CONTACT WITH THE COLONIES AND WILL PRODUCE AN EXACT REPLICA OF THE PLATE WHEN TOUCHED TO ANOTHER PETRI DISH. USUALLY ONE TOUCH WILL BE SUFFICIENT FOR PREPARING 8-10 PLATES ALTHOUGH WE SHALL PREPARE ONLY THREE.
(6) TOUCH THE REPLICATOR TO EACH OF THE THREE PLATES, AGAIN LINING UP THE BLACK MARKS SO THAT YOU WILL ALWAYS HAVE A POINT OF REFERENCE.
(7) COVER AND INCUBATE THE PLATES UPSIDE DOWN. THEY WILL APPEAR SIMILAR TO THOSE BELOW:

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PLATE A WILL APPEAR EXACTLY AS THE TEST PLATE APPEARED. ALL COLONIES WILL DEVELOP. HOLD PLATE A AND THE TEST PLATE UP TO THE LIGHT, LINING UP THE MARKS, ONE SUPERIMPOSED UPON THE OTHER TO PROVE THAT THEY ARE IDENTICAL.

PLATES B AND C WILL CONTAIN ONLY THOSE COLONIES THAT ARE RESISTANT TO THE ANTISEPTIC. NON-RESISTANT COLONIES WI[illegible] NOT DEVELOP. AGAIN SUPERIMPOSE B ON A AND HOLD THEM UP[illegible] THE LIGHT TO READILY SEE WHICH ONES DID NOT DEVELOP [illegible] THE SAME FOR PLATE C.

ECOSYSTEMS 17
OPTION #2

SUBJECT NAME	# OF COLONIES	# OF COLONIES	# OF COLONIES

OPTION #3 - one class period in the spring or fall (dry days)

MATERIALS AND RESOURCES

300 toothpicks per class

75 green
75 red
75 yellow
75 blue
} Dye with food color by soaking overnight, E^2 Office

Chart 1

PROCEDURE:

1. Place the 200 toothpicks in a 20'x20' square patch of lawn. They should be stuck into the ground so that they are about the height of the grass. It is best to place them the morning of the exercise.

2. Each 20'x20' square will be used by only one class so you will need a square for each class. You can stake out a grid and place all the toothpicks for six classes in about one hour.

3. Try to distribute the toothpicks as widely as possible so that the students will have to search longer.

4. Explain to the class, before they go out, that there are 300 toothpicks in their area. They may only use their eyes to hunt. They cannot find the toothpicks by feeling around on the grass. If violations of this rule get too flagrant make them put their hands behind their backs.

5. As the students search ask for them to signal when they get five toothpicks. When you have at least half of the class with five toothpicks. stop the hunt and return to the room. Be sure they hold onto their toothpicks

6. When you return to the room obtain a count of all the toothpicks by color. Give each student a copy of Chart 1 to record the class data.

7. Discuss.

DISCUSSION QUESTIONS

1. What color of toothpick seemed least likely to be found? Explain.

2. If this were a reproducing population, what might the second, third, and and fourth generations be like if no new colors were created?

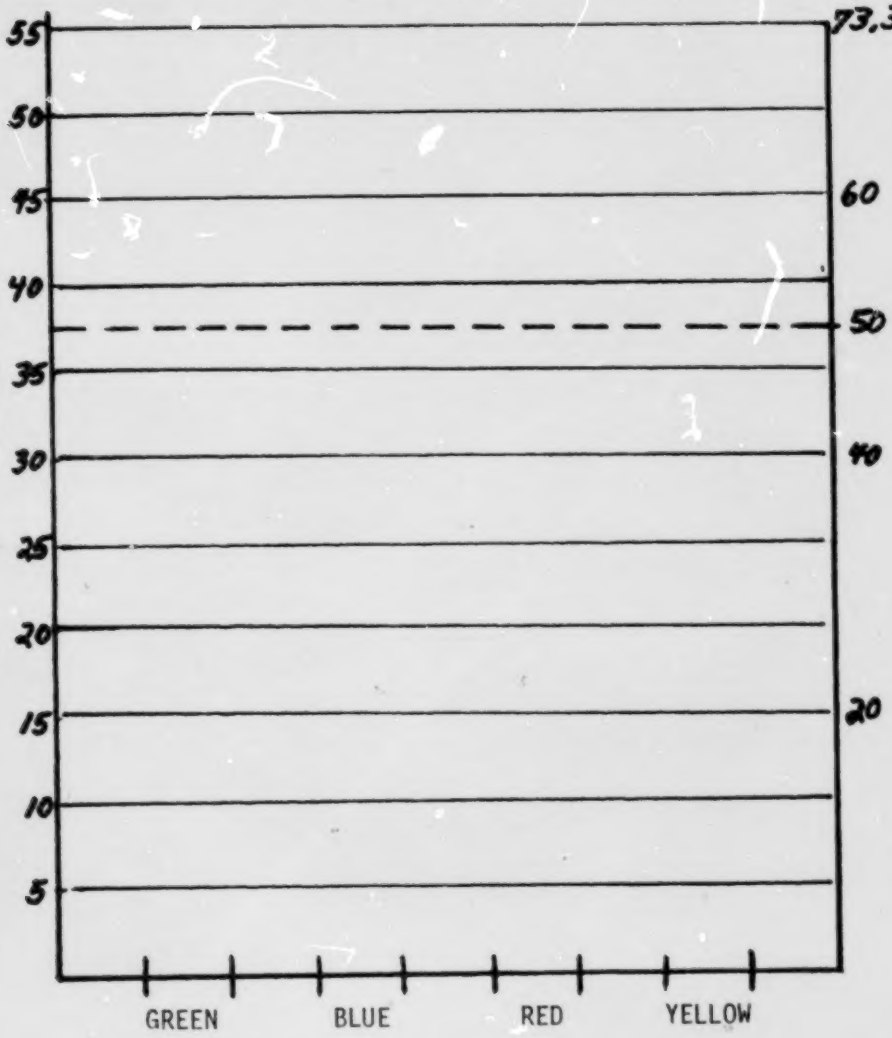
3. If the populations adapted to the selection by toothpick birds, which species would grow most over time? Why?

4. What would happen to the data if the birds had been blindfolded? If they had used touch and vision?

5. What examples do you know of species that have changed with their environment?

ECOSYSTEMS 17
OPTION #3

CHART 1



OPTION #3 continued

6. Do you know of any species that could not adapt to their environment? What happens to them?

7. Does man adapt to his environment? Would psychological changes, medicine, drugs, alcohol, or frequent vacations be adaptations?

8. From what you know of the social behavior of man, are we able to adapt rapidly to environmental changes?

9. How many of you would have survived if everyone needed eight toothpicks to live?

* As an interesting variation, you can use the previous days population to seed a new area(s) for another hunt. The results provide data for an interesting comparison.

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to list three examples of the complexity of ecosystems and explain their vulnerability to sudden or long-term disturbances.

SUBJECT AREAS:

Science, Social Studies, Mathematics

OPTION #1

MATERIALS AND RESOURCES

Stakes and string
Topographical maps, one per team
Collecting jars for insects
Trowels or small shovels (4)
Soil thermometers (2)
Soil Testing Kits (2)
Sling psychrometers (2)
Meter sticks (4)
Wind Velocity Gauges (2)
Tape measure
Air thermometers (4)
Light meter (1)
Binoculars (4)
Field study guides on birds, insects, flowers
Glossary
Task sheets covering habitat, soil, and climate
Instructor reference sheets
Cardboard

PROCEDURE:

This can be done in one or two class sessions outside if careful preparation takes place beforehand. Students should be familiar with the equipment, data expected, and recording techniques.

1. Introduce the concept of ecosystems and develop a working knowledge of the following terms: ecology, ecosystem, biotic, abiotic, biome, climax community, niche, autotroph, heterotroph, carnivore, herbivore, food chain, producer, consumer, decomposer and habitat. See glossary ditto.

2. Select a local wooded lot that has been relatively undisturbed by man. A mixed wooded lot will contain a diversity of organisms. The ideal time to study your field site is when it is fully developed vegetatively, although much can be learned by studying your site at various phases.

3. Divide the students into six teams, A-F.

4. A pre-field trip examination of topographic maps of the region will give the student an insight as to the relative location of the site, topography of the area, the influence of streams or rivers and the overall function of the site in the broader ecosystem. This may not be necessary, however.

5. At the site select a high point to observe the study area. Sketch a general overview of the area on your worksheet noting the boundaries of the actual study area. Be sure to include prominent land features that can be used as reference points in your study.

6. Approach your study area slowly in your small groups. (See worksheets) Visit the areas you have designated on your map as possible study sites.

OPTION #1 continued

7. Break into your teams and collect all your assigned data. Be observant as to the animal life using binoculars to help in identification as necessary. Note the location and abundance of the particular species.

8. Regroup at a predetermined site to discuss findings and evaluate data. Try to diversify your areas of study. Identify the vegetative species in the quadrant assigned you. Describe the abundance of each species as frequent - 20% (F); occasional - 10% (O); and rare - 1% (R).

DISCUSSION QUESTIONS

1. Write up and discuss in class the following:

   Summarize measurements, compare and contrast findings

2. From your observations of the data collected, determine the influence of the biotic and abiotic factors on each other keeping in mind the ecosystem concept. How did the abiotic factors affect vegetation?

   How did vegetation modify soil, air, etc?

   Did you observe plant-animal relationships?

3. Determine as many food chains as possible from your observations. Try to establish a food web for your site.

4. Based on your observations, is this site being used properly? If not, what would you recommend to insure its proper use in the future?

FURTHER ACTIVITIES

1. Find out from the owner(s) of the site what they propose to do with it in the future. You may be able to suggest some ideas based upon your findings.

2. Research a particular animal you found interesting. It is fun to predict the habits of the animal and then substantiate your predictions. Report to the class.

3. Study or research an ecosystem you would not find in your geographic area. How does it differ from your ecosystem? What were the major influential factors in causing the diversity observed?

ECOSYSTEMS 18 OPTION 1

STUDENT DIRECTIONS

1. At the site select a high point to observe the study area. Sketch a general overview of the area on your worksheet noting the boundaries of the actual study area. Be sure to include prominent land features that can be used as reference points in your study.
2. Approach your study area slowly in your small groups. See worksheets. Visit the areas you have designated on your map as possible study sites.
3. Break into your teams and collect all your assigned data. Be observant as to the animal life using binoculars to help in identification as necessary. Note the location and abundance of the particular species.
4. Regroup at a predetermined site to discuss findings and evaluate data. Try to diversify your areas of study. Identify the vegetative species in the quadrant assigned you. Describe the abundance of each species as frequent - 20% (F); occasional - 10% (O); and rare - 1% (R).

HABITAT

TASK A

1. EXPLORE AS MANY ENVIRONMENTS OR HABITATS AS YOU CAN FROM _____TO _____AND RECORD ANIMALS THAT YOU SEE OR ANY EVIDENCE OF ANIMALS. AS YOU INVENTORY THE ANIMALS OR THEIR EVIDENCES, FIGURE OUT SOME WAY OF RECORDING AMOUNTS OF EVIDENCES AND ANIMALS SEEN.
2. LOOK FOR AND LIST EVIDENCE OR SIGNS OF ANIMALS SUCH AS PARTLY CONSUMED FOODS, EXCREMENT, HOMES, BIRD NESTS, FEATHERS, ETC.
3. OBSERVE AND LIST DIFFERENT HABITATS FOR WILDLIFE IN THE AREA. (GRASS, CULTIVATED FIELD, HEDGES, SWAMP, ETC.)
4. OBSERVE AND LIST ANIMAL FOODS IN AREA.

TASK B

SELECT THREE DIFFERENT HABITATS AND COMPARE THE NUMBER AND KINDS OF ANIMAL ORGANISMS AND THE CHARACTERISTICS IN EACH.

HABITAT I	HABITAT II	HABITAT III
CHARACTERISTICS OF HABITAT I	CHARACTERISTICS OF HABITAT II	CHARACTERISTICS OF HABITAT III

TASK C

BUILD A FOOD PYRAMID SHOWING THE COMPARATIVE AMOUNTS OF ANIMAL AND ANIMAL EVIDENCES SEEN.

_____ 3° CONSUMER

_____ 2° CONSUMER

_____ 1° CONSUMER

PRODUCERS _____

TASK D

LIST THE ANIMALS YOU HAVE SEEN OR THEIR EVIDENCES IN THE APPROPRIATE PLACES IN THIS DIAGRAM. PUT IN ARROWS. WHAT OTHER WORDS AND WAYS CAN YOU THINK OF TO ILLUSTRATE A SIMILAR CYCLE?

LIGHT PLANT

NUTRIENTS HERBIVORES (PLANT EATERS)

DECOMPOSERS CARNIVORES (MEAT EATERS)

DEATH

WHAT WOULD HAPPEN IF ONE GROUP WERE ELIMINATED?

IF _____ I THINK THE FOLLOWING WOULD HAPPEN:

_____.

TASK E

CONSTRUCT A FIVE STAGE FOOD CHAIN USING SPECIFIC ANIMALS SEEN SO FAR.

TASK F

LIST THE EVIDENCES YOU SEE OF MAN'S EFFECTS UPON THE HABITAT. HAVE THE EFFECTS BEEN GOOD OR BAD?

REFERENCE SHEET

1. Soil Layers (Horizons)

   Mark where the soil changes color and texture. Many soils have three major layers or horizons, i.e. top soil, subsoil, and parent material, because soil formation has many variables you may find more or less. Measure and record the depth of each major layer.

2. Color

   Describe and record the texture of each major layer. Have participants pick their own description of color.

3. Texture (How the soil feels)

   Determine and record the testure of each major layer. Texture is determined by feel. Push and rub moistened sample between thumb and forefinger. Spit on sample to moisten.

   If it feels gritty .....sand

   If it feels smooth, slick, and not very sticky.....silt

   If it feels smooth, plastic, very sticky.....clay

   Note: Have samples of sand, silt, and clay in cans. Have participants practice with these samples to find out what the textures feel like before determining textures of the soil profile .

4. Structure (How the soil is put together)

   Determine the structure of each major layer. Carefully break apart a shovelful of soil from each layer and match its characteristics with one of the structure words on the lab sheet.

5. pH (acidity or alkalinity)

   Determine and record the pH of each major layer. Plants need many soil nutrients to grow well. The degree of pH affects how plants grow.

REFERENCE SHEET CON'T

NOTE TO INSTRUCTOR: DEMONSTRATE HOW TO USE PH KIT IN FRONT OF THE WHOLE GROUP. USE SOME FOREIGN MATERIAL LIKE CIGAR ASHES. MENTION NOT TO COMPACT THE SAMPLE IN THE PORCELAIN DISH, JUST USE ENOUGH PH REAGENT TO SATURATE SOIL SAMPLE, MATCH COLOR AT THE EDGE OF THE SOIL SAMPLE AND PORCELAIN DISH WITH PH COLOR CHART.

CONSTRUCTING A SOIL MICROMONOLITH

EXPLAIN THAT A MICROMONOLITH IS A SMALL CROSS SECTION OF THIS PROFILE. YOU CAN MAKE ONE BY JUST SKETCHING THE LAYERS ON THE PROFILE SKETCH IN TASK C OR PUTTING SAMPLES OF EACH LAYER IN A BABY FOOD JAR, ETC. NOTICE THERE IS A PLACE TO CHECK OR RECORD THE DATA YOU COLLECT AND A PLACE TO SKETCH WHAT THE SOIL LOOKS LIKE.

TASK SHEET (TEAMS C & D)

SOIL

Task A

Describe in writing your own description of soil. Keep this description for your own reference at the end of the session.

Task B

Predict what things you will find in the top few inches of this forest floor. List your predictions.

Stake out an area one or two feet square on the area floor and sift through the top three inches of the soil, recording the evidence of plant and animals you observe.

NAME OR DESCRIPTION OF ITEM IN SOIL	QUANTITY	POSSIBLE EFFECT

THE FOLLOWING THREE TERMS ARE USED TO DESCRIBE ORGANIC MATTER AT THE TOP OF THE SOIL - LITTER, DUFF, HUMUS. FROM YOUR STUDY ON THE PREVIOUS TASK SHEET, COMPLETE THE FOLLOWING CHART:

TERM AND DEFINITION	DESCRIBE THE FEEL	LIST IDENTIFIABLE PARTS OF PLANTS AND ANIMALS YOU FOUND
LITTER (IDENTIFIABLE DEAD THINGS ON THE SURFACE)		
DUFF (PARTIALLY DECOMPOSED ORGANIC MATTER-COMPACTED)		
HUMUS (ALMOST COMPLETE DECOMPOSED NON-IDENTIFIABLE ORGANIC MATTER)		

TASK C - 20-30 MINUTES - WORK IN SMALL GROUPS OR BY YOURSELF

CONSTRUCT A SOIL MICROMONOLITH OF THE SOIL PROFILE. RECORD YOUR OBSERVATIONS ON THE SOIL MICROMONOLITH LAB SHEET. SKETCH YOUR SOIL PROFILE, LABEL THE LAYERS OR HORIZONS, AND RECORD THE DATA.

PROFILE SKETCH

DATA

Contents of material above soil:

_____

Depth _____" to _____"

A. Horizon: Depth ____" to ____"

Color _____topsoil

Texture: Sand _____, Silt____,

Clay _____

Structure: Columns _____,

Blocky _____Platey _____,

Granules _____, pH _____,

Temperature _____

Plant roots visible _____

_____

Record below the same information as above for the rest of the layers.

TASK D

USING SOIL DATA YOU COLLECTED AND THE FOLLOWING TABLES, ANSWER THE QUESTIONS BELOW:

EFFECT OF SOIL DEPTH OF PLANT GROWTH AND WATER STORAGE

DEEP SOIL (OVER 42")	EXCELLENT WATER STORAGE AND PLANT GROWTH
MOD. DEEP SOIL (20"-42")	GOOD WATER STORAGE AND PLANT GROWTH
SHALLOW SOIL (20" & UNDER)	POOR WATER STORAGE AND PLANT GROWTH

THE POTENTIAL OF MY SOIL FOR WATER STORAGE AND PLANT GROWTH IS:

EXCELLENT _____ GOOD _____ POOR _____

WHY? _____

SOME RELATIONSHIP OF COLOR TO SOIL CONDITIONS

Top Soil Condition	Dark Dark grey, brown to black	Moderately Dark Dark brown to yellow brown	Light Pale brown to yellow
Amount of organic material	excellent	good	low
Erosion factor	low	medium	high
Aeration	excellent	good	low
Available nitrogen	excellent	good	low
Fertility	excellent	good	low

Subsurface soil color (B Horizon)	Condition
Dull Grey (if in low rainfall soils)	water-logged soils, poor aeration
Yellow, red-brown, black (if in forest soils)	well drained soils
Mottled grey (if in humid soils)	somewhat poorly to poorly drained soils

A. WHAT CAN YOU SAY ABOUT THE FOLLOWING BASED UPON THE COLOR OF THE TOPSOIL, OR A HORIZON?

AMOUNT OF ORGANIC MATERIAL _____

EROSION FACTOR _____

FERTILITY _____

B. WHAT CAN YOU SAY ABOUT THE DRAINAGE IN THE B HORIZON, BASED UPON COLOR?

Effect of texture on texture	Water holding capacity	Looseness of soil
Sand	Poor	Good
Silt	Good to excellent	Good
Clay	High (Plants cannot use it in clay)	Poor

MY SOIL TEXTURE	SOIL WATER-HOLDING CAPACITY	LOOSENESS
TOPSOIL (A)		
TOPSOIL (B)		

EFFECTS OF STRUCTURE ON SOIL CONDITIONS

TYPE	PENETRATION OF WATER	DRAINAGE	AERATION
Columns	Good	Good vertical	Good
Blocky	Good	Moderate	Moderate
Granular	Good	Best	Best
Platey (low rainfall soils)	Moderate	Moderate	Moderate

USING THE STRUCTURES YOU RECORDED AND THE CHART "EFFECTS OF STRUCTURE", WHAT CAN YOU SAY ABOUT THE DRAINAGE PROPERTIES OF YOUR SOIL FOR:

TOPSOIL (A) _____

SUBSOIL (B) _____

1 4.5 6.5 7 8.5 14

1 to 4.5 is too acid for most plants

Most plants do best here.

8.5 to 14 is too alkaline for most plants.

EXAMPLES OF PLANTS IN pH RANGE:

pH 4.0 - 5.0: Rhododendrons, camellias, azaleas, blueberries, fern, spruce

pH 5.0 - 6.0: Pines, firs, holly, daphne, spruce, oaks, birch, willow, rhododendrons

pH 6.0 - 7.0: Maple, mountain ash, ansy, asters, peaches, carrots, lettuce, pines, firs

pH 7.0 - 8.0: Beech, mock orange, asparagus, sagebrush

USING THE pH RANGES YOU RECORDED AND THE TABLE EXAMPLES OF PLANTS IN pH RANGE, COMPLETE THE FOLLOWING CHART:

SOME PLANTS THAT COULD GROW HERE BASED UPON THE pH AND CHART	SOME PLANTS ACTUALLY OBSERVED GROWING HERE

DID YOUR STATEMENTS ABOUT THE pH-PLANT RELATIONSHIPS CHECK OUT?

YES_____NO_____EXPLAIN:_____

IS pH THE ONLY FACTOR AFFECTING WHERE PLANTS GROW? YES __NO__

EXPLAIN: _____

TASK SHEET (TEAMS E & F)

CLIMATE

TASK A

SELECT A REPRESENTATIVE AREA OF THE SITE AND RECORD YOUR GENERAL OBSERVATIONS ABOUT THE AREA:

WIND SPEED - CALM, SLIGHT BREEZE, BREEZE, WINDY
LIGHT - DARK, SHADY, LIGHT, BRIGHT
HUMIDITY _____%
TEMPERATURE - BETWEEN ____AND _____(21 c = 70F)

TASK B

RECORD THE TEMPERATURE AT AT LEAST FOUR SITES ON THE MAIN SITE. ATTEMPT TO GET DATA FROM DIFFERENT AREAS THAT COVER THE FULL RANGE OF VARIANCES ON THE SITE. RECORD DATA AT EACH OF THESE HGTS:

2 METERS, 1 METER, 50 CM, 25 CM, 10 CM, 5 CM, GROUND LEVEL, -5 CM, -10 CM, -20 CM

NOTE: RECORD YOUR DATA CAREFULLY. YOU WILL HAVE 40 DIFFERENT NUMBERS BEFORE YOU ARE THROUGH.

TASK C

RECORD THE RELATIVE HUMIDITY ON A LINE TRAVERSING THE SITE AND FIVE METERS OUTSIDE THE BOUNDARIES, SEE FIGURE 1. MAKE AT LEAST SIX DIFFERENT READINGS AND BE CERTAIN THEY ARE FROM SITES AT LEAST 5 METERS APART.

FIGURE 1

Task D

Using the wind gauge select at least four sites that should have different wind effects and measure the wind velocity at four heights:

ground level, 25 cm, 1 m and 2 m

Note the characteristics that might account for these wind variations.

Task E

If a light meter is available, determine the available light at four separate sites. Take measurements at:

ground level, 1 meter and 2 meters plus reflected light (from the ground) at 1 meter

If no meter is available make qualitative judgements using shadow observations. Note the degree of contrast between shady and sunlit areas. The brighter the light available, the greater the contrast.

Task F

Using a wristwatch determine the relative noise on the site by measuring how far from your ear you can hold a watch and still hear it ticking. This is going to be comparative only so take a reading outside the shelter of the area being studied.

NOTE: Be certain the same person does this each time.

ECOSYSTEMS 18 OPTION 1

CLIMATE DATA SHEET

	Wind	Light	Humidity	Temperature
TEMPERATURE	Site 1	Site 2	Site 3	Site 4
2 m				
1 m				
50 cm				
25 cm				
10 cm				
5 cm				
ground level				
-5 cm				
-10 cm				
-20 cm				
RELATIVE HUMIDITY	Site 1	Site 2	Site 3	Site 4
	Site 5	Site 6		
WIND	Site 1	Site 2	Site 3	Site 4
LIGHT	Site 1	Site 2	Site 3	Site 4
NOISE				

GLOSSARY

ABIOTIC: NONLIVING

AQUATIC SUCCESSIONS: ECOLOGICAL SUCCESSION IN WATER ENVIRONMENTS

AUTOTROPHS: "SELF-FEEDING" ORGANISMS THAT CAN BUILD LARGE COMPOUNDS FROM SIMPLE NUTRIENT MOLECULES

BIOMES: LARGE BIOTIC COMMUNITIES THAT EXHIBIT SIMILAR PLANT AND ANIMAL ASSOCIATIONS AS WELL AS COMMUNITY STRUCTURE

BIOSPHERE: THAT PORTION OF THE EARTH OCCUPIED BY LIVING FORMS

BIOTIC: LIVING

CARNIVORE: A FLESH-EATING ANIMAL THAT OBTAINS ITS ENERGY INDIRECTLY FROM PRIMARY PRODUCERS BY EATING OTHER ANIMALS

CLIMAX COMMUNITY (MATURE ECOSYSTEM): THE FINAL STAGE IN THE SUCCESSIONAL PROCESS

COMMUNITY: ALL OF THE POPULATIONS OF ORGANISMS THAT EXIST AND INTERACT IN A GIVEN AREA

COMPETITION: A TYPE OF INTERACTION BETWEEN TWO POPULATIONS IN WHICH THEY VIE FOR THE SAME LIMITED RESOURCE.

CONSUMERS: ORGANISMS THAT DERIVE THEIR NUTRITION DIRECTLY FROM PLANTS (HERBIVORES) OR INDIRECTLY FROM THE PRODUCER BY WAY OF THE HERBIVORE (CARNIVORES)

CYCLE: A SEQUENCE OF EVENTS THAT RECUR REGULARLY

ECOLOGICAL SUCCESSION: THE DYNAMIC PROCESS BY WHICH ECOSYSTEMS CHANGE OVER TIME

ECOLOGY: THE SCIENCE THAT DEALS WITH THE INTERACTIONS BETWEEN LIVING ORGANISMS AND THEIR ENVIRONMENT; THE STUDY OF ECOSYSTEMS

ECOSYSTEM: SYSTEM OF LIVING ORGANISMS AND THE MEDIA THROUGH WHICH THEY EXCHANGE MATTER AND ENERGY.

ECOTONE: (EDGE EFFECT) TRANSITION AREA BETWEEN TWO BIOTIC COMMUNITIES

EUTROPHICATION: A NATURALLY OCCURRING "AGING" PROCESS IN AQUATIC COMMUNITIES WHERE PRODUCTIVITY INCREASES WITH A GRADUAL INCREASE IN NUTRIENT INPUT.

FOOD CHAIN: A SERIES OF FEEDING RELATIONSHIPS BETWEEN ORGANISMS THAT SHOWS WHO EATS WHOM.

FOOD WEB: A RELATIVELY COMPLEX SERIES OF INTERCONNECTED FOOD CHAINS

GLOSSARY CON'T

HABITAT: THE PLACE OR AREA THAT A SPECIES OCCUPIES

HERBIVORES: ANIMALS THAT FEED ON PLANTS

HETEROTROPH: "OTHER-FEEDING," ORGANISMS WHOSE NUTRITIONAL NEEDS ARE MET BY FEEDING ON OTHER ORGANISMS

MONOCULTURES: GREATLY SIMPLIFIED AGRICULTURAL ECOSYSTEMS HAVING ONLY ONE CROP

NICHE: A SET OF CHARACTERISTICS THAT DESCRIBE THE PRECISE REQUIREMENTS AN ORGANISM NEEDS TO SURVIVE

OMNIVORE: AN ORGANISM THAT EATS BOTH PLANTS AND ANIMALS

POPULATION: A GROUP OF ORGANISMS, ALL OF ONE KIND, LIVING WITH A GIVEN AREA

PREDATION: A TYPE OF INTERACTION BETWEEN TWO SPECIES IN WHICH ONE SPECIES (THE PREDATOR) ATTACKS AND KILLS ANOTHER SPECIES (THE PREY).

PRODUCERS: ORGANISMS THAT CAN CONVERT THE RADIANT ENERGY FROM THE SUN INTO CHEMICAL ENERGY BY PRODUCING ENERGY-RICH CARBON COMPOUNDS

SPECIES DIVERSITY: REFERS TO THE NUMBER OF DIFFERENT SPECIES OCCUPYING THE SAME AREA

OPTION #2

MATERIALS AND RESOURCES

Pea or bean seeds	24 styrofoam cups
Soil	Two small greenhouses constructed from saran wrap, plastic pans and coat hangers
Two pieces of plastic tubing	Two Erlenmeyer flasks
Right angle glass tubing (2)	One hole rubber stoppers (2)
Diagram 1	Data Chart
Source of H_2S (H_2SO_4 and FeS particles)	

PROCEDURE: NOTE OF CAUTION - H_2S has an extremely foul odor. Be certain to do this experiment under a hood or in a well ventilated area.

1. Soak seeds 24-48 hours before planting.
2. Plant seeds ahead of time in styrofoam cups (two to three weeks ahead of time).
3. Construct greenhouses with pans, coathangers and saran. (See Diagram #1.)
4. Hook up plastic tubing so it is airtight for adding gas to the greenhouse atmosphere. Use tape or aquarium sealer.
5. When one greenhouse is fumigated, the other will serve as a control, not exposed to H_2S at all.
6. Attach a length of plastic tubing to the pinch clamp and attach the other end to the tubing on the green house.
7. Open the valve and allow the H_2S to enter the greenhouse. Use very small doses at first and then increase the dosage if nothing happens.
8. Students should be instructed to keep track of the following on their data sheets:
   a. watering frequency including dates and quantity
   b. rate of plant growth, including height and dates in both greenhouses
   c. length of time the plants were exposed to H_2S and the quantities of FeS and H_2SO_4 used.
   d. date of appearance of damage to leaves and description of injury
   e. Take color slides of damage as it occurs and compare to normal leaves.

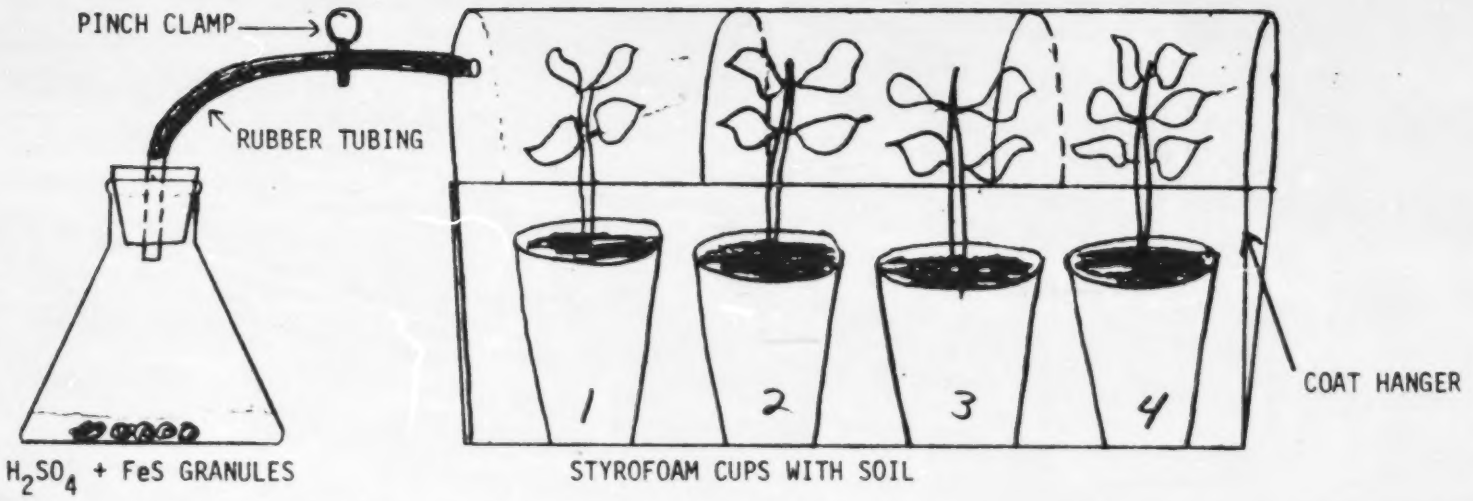
DISCUSSION QUESTIONS

1. What might be the source of H_2S in the atmosphere?
2. What happens when H_2S in the atmosphere combines with rain droplets in a shower? What compound is formed?
3. Can you suggest how this compound might affect plant growth?
4. When H_2S is absorbed by the leaves of the plant, the injury occurs. How does H_2S or any other gas enter the leaves?
5. Plants are more resistant to H_2S at night than during the day. Explain this on the basis of your answer to #4. Check your biology text on photosynthesis if necessary.

DIAGRAM 1

NUMBER EACH CUP FOR DATA PURPOSES.

POKE A DRAINHOLE IN THE BOTTOM.



MAKE TWO LARGE GREENHOUSES OR MANY SMALL INDIVIDUAL GREENHOUSES BIG ENOUGH FOR TWO TO SIX STYROFOAM CUPS. SMALL GREENHOUSES PERMIT INDIVIDUAL DATA AND DOSAGE CONTROL AND GREATER VARIANCE OF RESULTS.

OPTION #3

MATERIALS AND RESOURCES

Coal, Natural Gas, and Environment, FS/C
The Price of Progress, FS/C

OPTIONAL: The Role of the Interest Group Leader, 16 mm film } available E^2 Office
Eco-catastrophe, by Paul Ehrlich, included

PROCEDURE:

1. Show one or both of the filmstrips.
2. Discuss the issues.

DISCUSSION QUESTIONS

1. Is there really a price for progress? Explain.
2. Why are decisions made today so important?
3. Is it possible to be certain of the consequences of all of our actions which affect the environment? Explain.
4. What factors must be considered when we go into an area like the Four Corners Area to obtain energy needed in the rest of the country?
5. Are the areas which were stripmined restored to their approximate quality before stripmining?
6. Are these energy areas (coal, oil) subject to drastic long term changes?
7. How bad was the Santa Barbara oil spill? Is the area completely recovered?

PAGES 45-51 "Eco-Catastrophe!" by Paul Ehrlich removed prior to being shipped to EDRS for filming due to copyright restrictions.

RESOURCES

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ECOLOGY PRIMER, J.M. Melillo, Pendulum Press, Inc., 1972.

THE FOREST AND THE SEA; A LOOK AT THE ECONOMY OF NATURE AND ECOLOGY OF MAN, Random House, 1960.

FUNDAMENTALS OF ECOLOGY, E.P. Odum, Holt, Rinehart and Winston, 1973.

The Community: color film, Encyclopedia Britannica Film Inc., 1150 Wilmette Avenue, Wilmette, Illinois 60091

The High Artic Blows: 22 minutes, color film, Encyclopedia Britannica Films, Inc.

Life in the Desert. 12 minutes, color film, EBF

Life in the Forest: 12 minutes, color film, EBF

Life in the Grasslands: 12 minutes, color film, EBF

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to list three examples of how human beings are capable of drastically altering the cycles and system of the earth.

SUBJECT AREAS:

Social Studies, Science

OPTION #1

MATERIALS AND RESOURCES

On the Beach
Hiroshima
The Nuclear Threat to You, videotape available E^2 Office
Notebooks for gathering information and data

PROCEDURE:

1. Assign well in advance, depending upon the student level, one of the above two books or show the videotape the day before the discussion.

2. Assign students to observe the following and take notes to be shared in class discussion:

   a. Home heating system - How is it a closed system? What cycles are involved?
   b. The classroom environment - good and bad features, recommended improvements
   c. School environment - presence or absence of trees, wildlife, plant life. How much of this is natural? How much is created by man?

DISCUSSION QUESTIONS

1. Which systems or cycles you observed were protected by man? Which were being destroyed?

2. How would you improve the environments you observed?

3. What actions by man can preserve natural cycles or systems?

4. Which actions can disrupt them?

5. How is man's psychological/sociological behavior altered as the scientific systems are changed?

6. In the book, Hiroshima, how does the author bring out changes in human behavior due to man's alteration of the environment?

7. How does the chapter, "Panic Grass and Fever Few" relate to the idea of a cycle or system? What is the underlying meaning or symbolic comment here?

8. Which behavioral cycles were upset due to the bomb? How did mankind compensate for the changes in his environment?

9. How are irony and paradox a natural result of upsetting one's environment?

   a. Things which are normally vulnerable survive the blast, while seemingly indestructible objects vanish.
   b. No noise at ground zero - only heard miles away.
   c. Great leveling of social status.

OPTION #1 con't

10. What are the main differences between On the Beach and Hiroshima?

11. In what way is On the Beach a novel of despair over mankind's upsetting the natural environment?

12. Imagine that the areas you analyzed in the notebook underwent an atomic or nuclear experience, for example, a direct hit or fallout. Select one of the sites and rewrite an entry explaining how it would have changed. Be descriptive and realistic. Include vegetation, people, buildings, weather, etc.

13. How does the video tape change your view of nuclear power?

14. Do you have faith in man's ability to regulate nature?

15. Who should decide what happens with nuclear power?

OPTION #2

MATERIALS AND RESOURCES

Soil analysis kit, available E^2 Office

Access to lawns

Charts 1 and 2

PROCEDURE:

1. Discuss the normal mineral cycles that take place on a lawn in which fertilizers, pesticides and herbicides are not used.

2. What effects do fertilizers, pesticides, herbicides and grass catchers have on the mineral cycle described above?

3. Prepare a soil analysis on a lawn containing monoculture grass and prepare an analysis on a lawn containing a wide variety of plant species.

4. Survey the lawns along several streets around your community to determine the following usage?

   a. soil tested before applying fertilizer
   b. fertilizer used
   c. pesticide used
   d. herbicide used

DISCUSSION QUESTIONS

1. What did you observe about the color and texture of each lawn?

2. Which lawn required more care and was more costly to maintain?

3. From the information learned from soil analysis, were beneficial chemicals being applied?

4. Is what you observed in the street around your community typical of your community? State? Nation?

5. Does lawn care affect other ecosystems?

6. What consequences might occur if what you saw continued to be the pattern over a period of time?

CHART #1

MANAGED LAWN

INPUTS

FERTILIZER ($) spring and fall

HERBICIDES ($) to control weeds

PESTICIDES to prevent damage from insects

LABOR to mow lawn often

CONCERN to avoid damage to the monoculture

WATER to feed growing lawn

ENERGY to run power mower

CONCERN over people crossing lawn

OUTPUTS

Excess nutrients that are not needed

Grass clippings

Green carpet

Brown carpet when hot

Admiration from neighbors

Personal pride

Work to occupy leisure time

"American Heritage" LAWN

INPUTS

Less fertilizer

No herbicides

No pesticides

Less labor in mowing

No concern over monoculture

Less water needed

Less energy used for mowing

OUTPUTS

Dandelions

Possible anger from neighbors

Variable green all year long

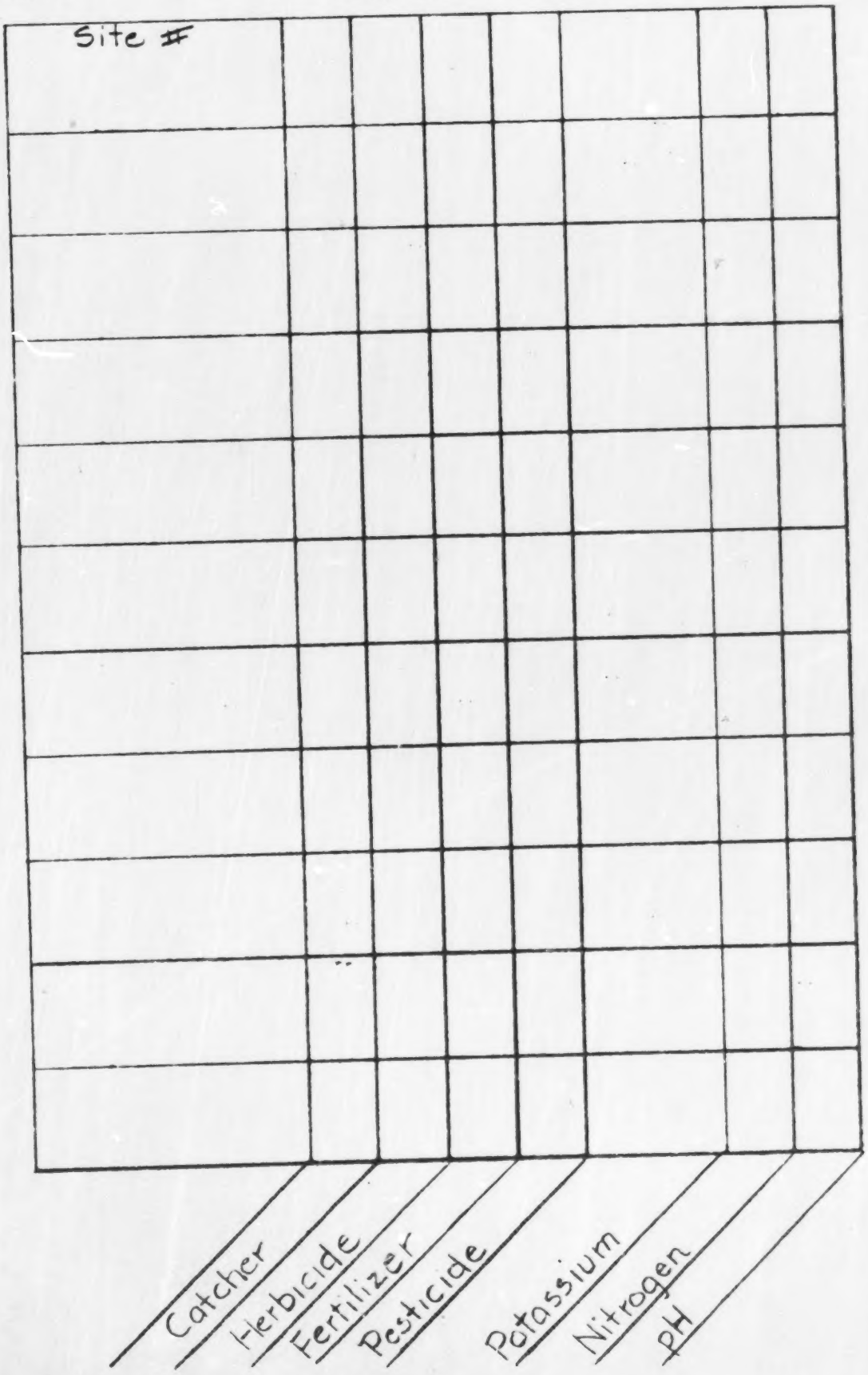
Good hardy play area

More leisure time to worry about

Fewer clippings and less mulch

OPTION 2

OPTION #2 LAWN SURVEY FORM CHART 2



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OPTION #3

MATERIALS AND RESOURCES

News item
Figure 1 (study area)
Table 1 (data chart)
System diagram

PROCEDURE:

1. Give each student a copy of Diagram 1 and discuss what we mean by a system using some common examples, e.g. home heating system, our appetite, our breathing system, etc.

2. Discuss the various inputs, outputs, and changes which take place in the various systems and have them fill in the chart.

3. When you see they have a good grasp of the concept, give them a copy of Figure 1 and Table 1.

4. Explain that you want to compare two (2) plots of equal size (50 acres). One is an asphalt parking lot. The other is an open field.

5. Using the three types of conditions, ask them to list inputs and outputs.

6. When they have completed the table ask them to suggest ways they can reduce the negative factors associated with the various outputs.

7. Lead this discussion toward alternatives to paving these parking areas. Hand out news item.

DISCUSSION QUESTIONS

1. It is obvious that man can greatly alter a system. Can we make a statement about the good or bad aspects of this power?

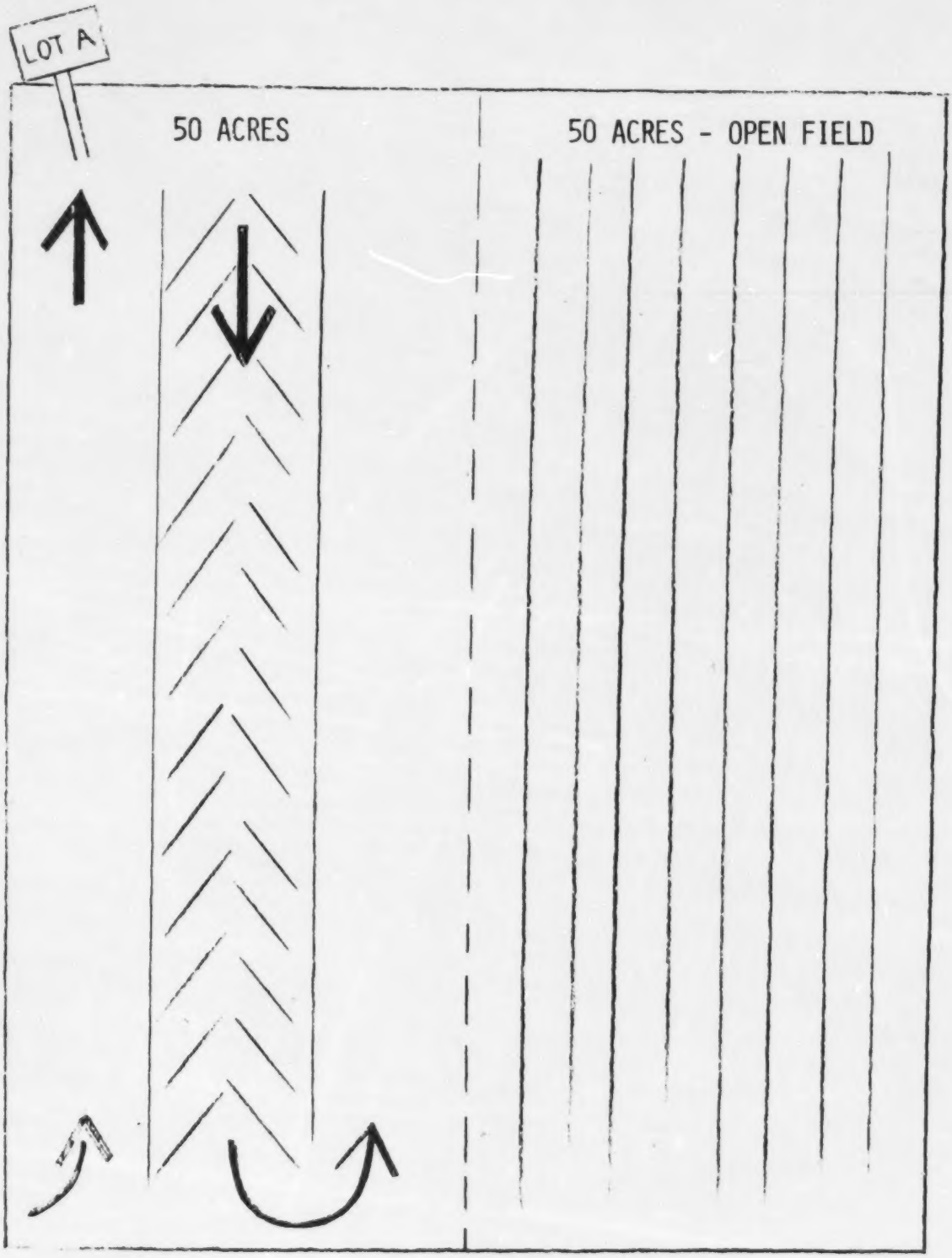
2. Do we generally know the system very well when we try to alter it?

3. Are there guidelines to aid us in deciding when to change a system? What should they be?

4. What factors do we consider when we modify an ecosystem?

PAGE 60 "Environment: Grass Grows in Parking Lots" removed prior to being shipped to EDRS for filming due to copyright restrictions.

FIGURE #1



PAVED IN ASPHALT LEADING TO A DRAINAGE SEWER

OPEN FIELD WITH ONLY "WEEDS" NO TILLAGE

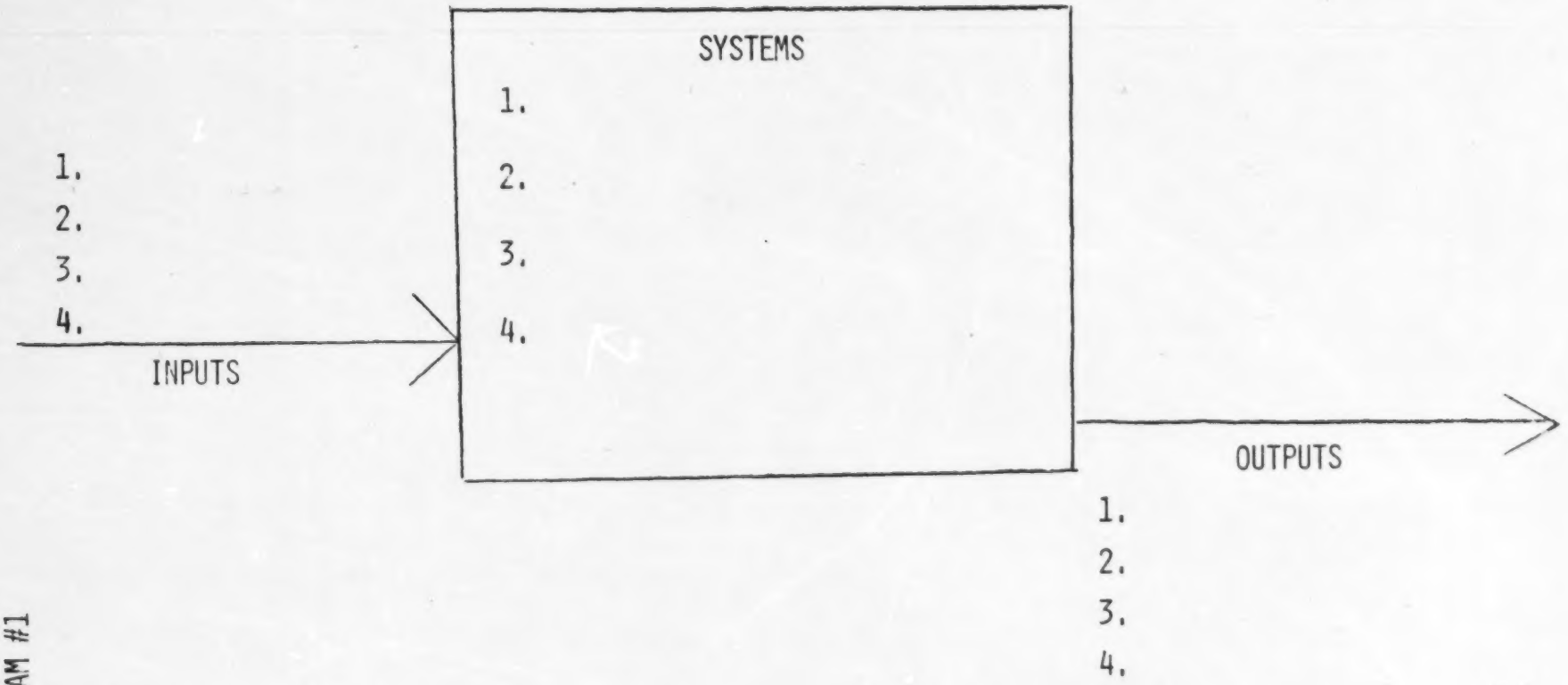


DIAGRAM #1

INPUT FACTOR	PARKING LOT (PAVED)	OPEN FIELD
SNOWFALL (SUSPENDED PARTICULATES)	OUTPUTS 1. MELT WATER 2. OIL DRIPPINGS 3. 4. 5. 6. } carried to storm sewer by flowing water	OUTPUTS 1. SEEDS 2. DIRT 3. ANIMAL DROPPINGS 4. NUTRIENTS } absorbed into the soil with the water
RAINFALL	OUTPUTS 1. 2. 3. 4. 5. 6.	OUTPUTS 1. 2. 3. 4. 5. 6.
BRIGHT SUNNY DAY	OUTPUTS 1. 2. 3. 4. 5. 6.	OUTPUTS 1. 2. 3. 4. 5. 6.